Determining Peak Activity Times of *Aedes albopictus*
Using New BG-Counter and Modified Rotator Trap

By Jay Kiser
City of Suffolk
Importance of Knowing Hourly Distributions of Your Mosquitoes

• Knowledge of mosquito behaviors can help with their control

• In adult mosquito control
  – Traps are set to find adult mosquito populations
  – Spray routes are then planned according to those trap collections.
  – Depending on the species caught, the time these spray routes take place can be altered for more effective control
Importance of Knowing Hourly Distributions of Your Mosquitoes

• Generalizations
  – Dusk and dawn
    • Common phrasing given to citizens to protect themselves
    • But not all species
Past Research On Mosquito Activity Times/Hourly Distributions

**Aedes canadensis**

**Culiseta melanura**

---

**Monthly Aedes canadensis Counts per Trap Night at Regency**

---

**Monthly Lake Kennedy Culiseta melanura Counts per Trap Night**
Past Research On Mosquito Activity Times/Hourly Distributions

Gravid Study
Suffolk repeated PA’s Study

\[ \text{Culex p. p. restuans distributions} \]
One Important Species We Were Still Interested in... *Aedes albopictus*

- Urban species
- Found near artificial containers holding water
- Active during the day
  - Daytime biters
Biogents BG-Counter
Remote Mosquito Monitoring

Designed for surveillance in remote areas

• BG trap fitted with a mosquito counting device

• Device sends data and is uploaded to website
  – Mosquito counts is 15 min intervals

• Device can be turned on and off remotely from your computer
  – Fan, Counter, CO2 Tank
An insect is sucked through the BG-Counter and disrupts infrared rays. This is detected by the light detectors.

Filter

Filter by insect type
- Show Mosquitoes
- Show large objects
- Show small objects

Filter by time (2015-10-28T00:00 - 2015-10-29T00:00)

Chart of Captures from 2015-10-28T00:00 to 2015-10-29T00:00

February 2016
Working With The BG-Counter

2015

• Trapped during October and November
  – 11 trapnights

• Looked at the accuracy of the counter
  – BG vs Human Count
    • 91% accurate
Working With The BG-Counter

2016

• Focused on *Aedes albopictus*

• Chose an area with historically high *Ae. albopictus* populations and low mosquito diversity
### Working With The BG-Counter

#### 2016

- Trapped twice a week from June-September
  - Trapped for 24 hours, took trap away for at least 24 hours before trapping again
  - 29 trapnights

- Human vs Counter
  - Average of 95% accuracy

- 11,985 mosquitoes collected (90.9% *Ae. albopictus*)
  - 5,524 males (99.9% *Ae. albopictus*)
  - 6,461 females (83.2% *Ae. albopictus*)
    - *Ae. triseriatus* (6.9%)
    - *Cs. melanura* (2.3%)
    - *Cs. salinarius* (2.2%)
    - *Cx. pipiens* (1.7%)
    - *Ae. vexans* (1.5%)
    - Other species (2.2%)

#### Assumptions In Data Analysis

- Behaviors may change throughout the season
  - Sunset times, temperature, changes in host species

- Avoid consecutive trapping days
  - Allow the population to recoup

- Counter is 95% accurate
  - 5% error is assumed to be distributed evenly

- 90.9% *Ae. albopictus*
  - 9.1% of the data is non albopictus

- Males made up 46.1% of mosquitoes
  - 50.7% of all *Ae. albopictus*
  - Looking at *Ae. albopictus* behavior as a whole, assuming male and female activity times are the same
Total number of *Aedes albopictus* Collected from June-September 2016 in 15 Minute Intervals

- **Artificial peak due to initial introduction of trap into the environment**
- **True Peak 17:30-18:00**
- **Sunset**
- **Sunrise**

**Number of Mosquitoes**

15 min intervals in 24 hour time

- Aedes albopictus (91%)
Sunset and Sunrise

• Previous graph shows total mosquito counts from June-September
  – Seasonal average for June-September
    • Sunset – 7:55pm
    • Sunrise – 6:16am
• Changes in Sunset and Sunrise times
  – monthly data

<table>
<thead>
<tr>
<th>Month</th>
<th>Sunset</th>
<th>Sunrise</th>
</tr>
</thead>
<tbody>
<tr>
<td>April</td>
<td>7:43 pm</td>
<td>6:28 am</td>
</tr>
<tr>
<td>May</td>
<td>8:05 pm</td>
<td>6:00 am</td>
</tr>
<tr>
<td>June</td>
<td>8:23 pm</td>
<td>5:49 am</td>
</tr>
<tr>
<td>July</td>
<td>8:20 pm</td>
<td>6:02 am</td>
</tr>
<tr>
<td>August</td>
<td>7:45 pm</td>
<td>6:30 am</td>
</tr>
<tr>
<td>September</td>
<td>7:12 pm</td>
<td>6:47 am</td>
</tr>
<tr>
<td>October</td>
<td>6:35 pm</td>
<td>7:13 am</td>
</tr>
</tbody>
</table>
Monthly Collections

Average Number of Mosquitoes Caught per 15 Minute Intervals per Month
June Collections

Average Number of Mosquitoes Caught per 15 Minute Intervals for June

Sunset 20:23

17:30
July Collections

Average Number of Mosquitoes Caught per 15 Minute Intervals for July

17:45-18:45
Sunset
20:20
August Collections

Average Number of Mosquitoes Caught per 15 Minute Intervals for August

- Sunset 19:45
- 17:30-18:15

Number of Mosquitoes

- August
September Collections

Average Number of Mosquitoes Caught per 15 Minute Intervals for September

Sunset
19:12

17:15-17:45
BG-Counter vs Landing Rates

Standardization of Landing Rates

• Same person doing rates
  – Jay Kiser
• Same time of day
  – Between 7:30-8:00am
• Same amount of time
  – 5 minute landing rates
• Same counting behaviors
  – Mosquitoes-
  – Counter- posture, movements, clothing

• Conducted landing rates
  – June – August
  – Two locations
    • 50 meters from trap
    • 20 meters from trap
  – 13 times at trap pickup
  – 8 times at trap set
BG-Counter vs Landing Rates

Minute Average Human Landing Rates vs BG-Counter Collections at Trap Set and Pick Up

- 50 meters
- 20 meters
- 15 min of BG Collection
- 1hr of BG Collection
- 2hr of BG Collection
- 24hr of BG Collection

Mosquitoes at Minute Average

At Trap Set

At Trap Pick up
BG-Counter vs Landing Rates

Correlation Between Landing Rate and BG Counts After 15 min

- Observed
- Predicted
BG-Counter vs Landing Rates

Observed Behaviors During Landing Rates

- Number of males
  - Hovering
  - Landing

- Number of mating pairs
  - Hovering
  - Landing with female probing
  - Observed 4 out of the 21 landing rates taken at 20m
Looking For Behavioral Differences Between Male and Female *Aedes albopictus*

- Due to
  - Large numbers of male *Aedes albopictus* collected in the BG-Counter
  - Presence of males and mating during landing rates

- Created a modified Rotator Trap
  - Look for differences in activity rates between males and females
What is a Rotator Trap?

CDC Bottle Rotator Trap

- Modified CDC Light Trap
  - **Same** fan
  - **Same** light attracts
    - Light bulb and CO₂
  - **Different** collection chamber setup
    - Has multiple chambers
    - Active collection chamber changes throughout night
    - Programmable time setup for chamber rotation
  - **Different** Battery Needed
    - 12Volt needed instead of 6volt
Rotator Traps
Modifications to Rotator Chambers

- Standard chamber bottles hinder airflow.
  - Less suction
  - Less mosquitoes
- CDC light trap style chambers are available
- Suffolk modifies chamber bottles
  - Cut off plastic bottoms
  - Replace with screen
Knocking Down Mosquitoes

- Hot Shot No-Pest Strip$_3$
  - Active Ingredients Dichlorvos
    - (2,2-dichlorovinyl dimethyl phosphate) ...... 18.6%
- Cut into strips
- Store with chambers
  - In Tupperware $\geq$ 7 days
- Treated chambers knockout mosquitoes during night of collection
- Pesticide replace halfway through season
Creating the BG-Rotator
Creating the BG-Rotator
Creating the BG-Rotator
Creating the BG Rotator
BG-Rotator vs BG-Counter

• 11 trapnights
• August and September
• BG-Rotator
  – 1pm-8pm
  – Chambers switch 1 hr
• BG-Counter
  – 24 hr
• 1,180 mosquitoes
  – 509 males
    • 100% Ae. albopictus
  – 671 females
    • 96% Ae. albopictus
BG-Rotator vs BG-Counter

Hourly Distribution of *Aedes albopictus* Collected in the BG Counter vs BG Rotator
Males vs Females Collected in BG-Rotator

Hourly Distribution of Male and Female *Aedes albopictus*
Collected From the BG Rotator
Males vs Females Collected in BG-Rotator

Hourly Distribution of Male and Female *Aedes albopictus* Collected From the BG Rotator in the Month of August
Total number of *Aedes albopictus* Collected from June-September 2016 in 15 Minute Intervals

Number of Mosquitoes

15 min intervals in 24 hour time

Aedes albopictus (91%)
Conclusions

• Aedes albopictus:
  – Peak of activity around 5:30-6pm
  – About 2 hours before 2-3 hours before sunset
  – 4:45-7:15pm 27% of all mosquitoes collected

• Males vs Females
  – The above peak maybe due to males
  – More trapping is needed

• How does this help with control?
Future Plans

• Continue looking at *Aedes albopictus* activity
  – Using the BG-Counter
  – Trap throughout the season
    • June-September
• Continue looking at Male vs Female activity
  – Using BG-Rotator
  – Widen the time of trapping
  – Smaller increments of time
• Trap-Spray-Trap Studies
  – Compare Times of Spraying
Acknowledgements

• Thank you
  – Biogents
  – City of Suffolk
  – Karen Akaratovic
  – Charles Abadam
  – Jamie Durden

Questions?